ROOF MEMBRANE FASTENER, SYSTEM, AND FASTENING METHOD

BACKGROUND OF THE INVENTION

The subject invention relates to a multi-layer roof sheet membrane system, to a method of installing the multi-layer roof sheet membrane system on a roof substrate, and to a roof sheet membrane fastener assembly for securing roof sheet membranes of the system to a roof substrate. More specifically, the subject invention relates to a multi-layer roof sheet membrane system that includes roof sheet membranes with topside adhesive surfaces that are overlaid by topside release sheets that are removed subsequent to securing the roof sheet membranes with mechanical fastener assemblies to a roof substrate.

Certain multi-layer roofing systems utilize base sheet membranes, such as the multi-layer roofing base sheet membranes sold by Johns Manville International, Inc. under the trade designation DynaGrip®, that have self-adhering topside and bottom side surfaces. The topside and bottom side self-adhering surfaces of these multi-layer roofing base sheet membranes are designed to enable an asphalt to asphalt bonding between roof membrane layers, an asphalt bonding of the membranes to a roof deck or other roof substrate, and an asphalt bonding of fire retardant cap sheet membranes that do not have self-adhering bottom side surfaces to an underlying layer of the roofing system formed by the base sheet membranes. Other multi-layer roofing systems utilize base sheet membranes having non-adhesive topside surfaces and self-adhering bottom side surfaces. Prior to installation, release sheets overlay the self-adhering surfaces of these base sheet membranes to protect the self-adhering surfaces from degradation.

However, for certain applications adhering the base sheet membranes directly to a roof deck or other roof substrate is not a preferred means of attachment. For example, adhering base sheet membranes of a multi-layer roofing system directly to a wooden roof deck presents a problem when the base sheet membranes must be torn off and removed from the deck prior to re-roofing the wooden deck. It is difficult to tear off and remove these self-adhered base sheet membranes from the wooden deck and frequently many of the deck boards are damaged and unusable after the self-adhered base sheet membranes have been torn off the deck. Since the boards of a wooden roof deck are relatively expensive

to replace, where possible, wooden deck roofers want to avoid the expense of replacing the boards of a wooden roof deck by reusing the existing deck boards.

One way that has been used to avoid damage to a wooden roof deck when using base sheet membranes with topside and bottom side self adhesive surfaces is to insert sheet layers with non-adhering bottom side surfaces between the self-adhering base sheet membranes and the wooden roof deck; secure the inserted sheet layers to the wooden roof deck with mechanical fasteners; and adhesively secure the base sheet membranes with the topside and bottom side self-adhering surfaces to the topside surfaces of the inserted sheet layers. An example of such a sheet layer with a non-adhesive bottom side surface that may be inserted between a base sheet membrane with a self-adhering bottom side surface and a wooden deck is an aluminum foil polyester sheet laminate sold by Johns Manville International under the trade designation DeckPro®. Damage to a wooden roof deck when using base sheet membranes that have non-adhesive topside surfaces and self-adhering bottom side surfaces can also be avoided by using an inserted sheet layer with a non-adhesive bottom side surface. While this solution to the problem of wooden deck damage works very well, it is a relatively expensive solution.

Another way that has been used to avoid damage to a wooden roof deck when using base sheet membranes with non-adhesive topside surfaces and self-adhering bottom side surfaces has been to apply a parting agent such as sand or granules to the bottom side surface of the base sheet membranes so that the bottom side surfaces are not self-adhering and securing these base sheet membranes directly to the wooden roof deck with mechanical fasteners. However, self-adhering topside surfaces of base sheet membranes made with topside self-adhering surfaces are typically made of asphalt, are very sticky, and, once exposed, are not conducive to foot traffic, kneeling, or other roofer contact. Accordingly, due to the need to retain the topside release sheets on the self-adhering topside surfaces of these base sheet membranes overlying the self-adhering topside surfaces of the membranes to prevent degradation of the self-adhering topside surfaces and facilitate the handling of these base sheet membranes while the roofers are installing such base sheet membranes and the need to be able to easily remove the topside release sheets from the self-adhering topside surfaces and expose the self-adhering topside surface of these base sheet membranes for bonding the self-adhering topside surfaces of these membranes to overlying roof

layers, mechanical fasteners have not been used to secure base sheet membranes with self-adhering topside surfaces directly to roof decks.

Thus, for multi-layer roofing systems that utilize base sheet membranes with self-adhering topside and bottom side surfaces and for multi-layer roofing systems that would use base sheet membranes with self-adhering topside and non-adhesive bottom side surfaces, there has remained a need to provide a less expensive and easy to use solution to the problem of securing such base sheet membranes to wooden roof decks and other roof substrates that can be damaged when removing the base sheet membranes if they are adhered to the roof substrate. The solution should permit roofers: to easily handle and walk over these base sheet membranes while the base sheet membranes are being secured to the roof substrate; to walk over, kneel on, and otherwise make contact with these base sheet membranes after they have been secured to the roof substrate and prior to installing cap sheet membranes or other overlying layers to these base sheet membranes; and to walk over, kneel on and otherwise make contact with the base sheet membranes and/or overlying layers of a multi-layer roof system after the base sheet membranes have been secured to the roof substrate without degrading the base sheet membranes.

SUMMARY OF THE INVENTION

The multi-layer roof sheet membrane system and method of the subject invention provide such a solution. The multi-layer roof sheet membrane system and method of the subject invention secure base sheet membranes with self-adhering topside surfaces to a wooden roof deck or other roof substrate with mechanical fastener assemblies: that permit the topside release sheets overlying the self-adhering topside surfaces of the membranes to remain in place until the next layer of the multi-layer roof membrane system is to be installed; that permit the easy and quick removal of the topside release sheets to expose the self-adhering topside surfaces of the base sheet membranes once the overlying layer or layers of a multi-layer roof membrane system are to be installed; and that permit roofers to walk over, kneel on and otherwise make contact with the base sheet membranes and/or overlying layers of a multi-layer roof membrane system after the base sheet

membranes have been secured to the roof substrate without degrading the base sheet membranes.

The multi-layer roof sheet membrane system of the subject invention includes a base sheet membrane with a self-adhering topside surface that is overlaid by a topside release sheet. Preferably, the roof sheet membrane is secured to a roof substrate solely by a plurality of mechanical fastener assemblies with no adhesive bonding between the roof sheet membrane and the roof substrate. Each of the mechanical fastener assemblies includes a mechanical fastener passing through the topside release sheet and base sheet membrane and into the roof substrate to secure the base sheet membrane to the roof substrate and a disk through which the mechanical fastener passes. The disk contacts and overlays a portion of the topside release sheet immediately surrounding the mechanical fastener and causes the portion of the topside release sheet overlaid by the disk to be easily separable from a remainder of the topside release sheet when the topside release sheet is torn or otherwise removed from the base sheet membrane prior to adhering an overlying roofing layer to the base sheet membrane. Thus, once the release sheet is removed from the self-adhering topside surface of the base sheet membrane, the self-adhering topside surface of the base sheet membrane, except for the limited portions covered by the mechanical fastener assemblies, is exposed for effectively and securely bonding to an overlying layer of the multi-layer roofing system to the base sheet membrane.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a partial schematic plan view of a multi-layer roof membrane system of the subject invention installed on a wooden roof deck with portions of the system broken away to better show underlying layers of the system.

Figures 2 to 4 are schematic perspective views of three embodiments of the mechanical fastener assemblies of the subject invention with the disks of the assemblies slid partially down the shanks of the mechanical fasteners.

Figure 5 is a topside view of a disk of the mechanical fastener assembly of the subject invention.

Figure 6 is a transverse cross section of the disk of Figure 5 taken substantially along lines 6-6 of Figure 5 and showing a peripheral separation edge depending from the peripheral edge of the peripheral edge portion of the disk.

Figure 7 is a fragmentary cross section, on a larger scale, of the disk of Figures 5 and 6 to better illustrate the depth "D" of the peripheral separation edge of the disk.

Figure 8 is a side view of the disk of Figure 5 wherein the peripheral separation edge in the peripheral edge portion of the disk is a toothed cutting edge.

Figure 9 is a side view of the disk of Figure 5 wherein the peripheral separation edge in the peripheral edge portion of the disk is a plane cutting edge.

Figure 10 is a partial schematic plan view of a base sheet membrane with a self-adhering topside surface covered by a topside release sheet that is peeled back at one corner. Mechanical fastener assemblies of the subject invention secure the base sheet membrane to a roof substrate.

Figure 11 is a partial schematic plan view of the base sheet membrane of Figure 10 with the topside release sheet partially torn away (in the process of being removed) to expose the self-adhering topside surface of the membrane.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows a partial plan view of an example of a multi-layer roof sheet membrane system of the subject invention 20 installed on a roof substrate 22 with portions of the multi-layer roof sheet membrane system 20 broken away to better show underlying layers of the system. The multi-layer roof sheet membrane system 20 includes a base sheet membrane 24 and a cap sheet membrane 26 with a mineral surfaced topside major surface 28 that is bonded to the base sheet membrane 24 by the asphalt coated self-adhering topside major surface 30 of the base sheet membrane. The base sheet membrane 24 may be a self-adhering topside and bottom side base sheet membrane that preferably has a sheet, sand, or granular layer interposed between the bottom side major surface of the membrane and the roofing substrate 22 to keep the base sheet membrane from adhering to the roofing substrate or the base sheet membrane 24 may be a base sheet membrane with a self-adhering topside major surface and a non-adhesive bottom side major

surface. The roof substrate 22 is a roof substrate, such as but not limited to a wooden roof deck, that, were the base sheet membrane to be adhered to the roof substrate, could be damaged by the removal of the base sheet membrane 24 from the roof substrate.

The base sheet membrane 24 is anchored or secured to the roof substrate 22 by a plurality of mechanical fastener assemblies 40 of the subject invention. The pattern and relative spacing of the mechanical fastener assemblies 40 securing the base sheet membrane 24 to the roof substrate 22 is selected to assure that the base sheet membrane 24 is firmly anchored to the roof deck and exhibits the required wind uplift resistance. The base sheet membrane 24 and the cap sheet membrane 26 are typically waterproof membranes between about 36 inches and about 40 inches in width.

Figures 2 to 4 show perspective views of three embodiments of the mechanical fastener assemblies 40 of the subject invention. Each of the mechanical fastener assemblies includes a mechanical fastener 42 and a disk 44. The mechanical fastener 42 of the mechanical fastener assembly 40 of Figure 2 is representative of a conventional roofing nail that is designed to be driven through a roof sheet membrane and into a roof substrate by hammering or pounding the roofing nail to secure or anchor the roof sheet membrane to the roof substrate. While the roofing nail of Figure 2 has a plane shank, the shank of the roofing nail may have other configurations such as but not limited to an annular thread (a series of annular grooves); a spiral thread (a spiral groove), and/or a barb at the lower end. The mechanical fastener 42 of the mechanical fastener assembly 40 of Figure 3 is representative of a conventional roofing screw. The shank of the roofing screw of Figure 3 has a spiral groove and the head of the roofing screw is slotted or has a recessed head designed to receive a tool for rotating the roofing screw. The shank of the roofing screw is designed to be inserted through a roof sheet membrane and into a roof substrate by rotating the roofing screw to secure or anchor the roof sheet membrane to the roof substrate. The mechanical fastener 42 of the mechanical fastener assembly 40 of Figure 4 is representative of a conventional roofing staple. The roofing staple of Figure 4 has a generally U-shaped configuration with two slender shank portions and the shanks of the staple are designed to be driven through a roof sheet membrane and into a roof substrate to secure or anchor the roof sheet membrane to the roof substrate.

The disks 42 of the mechanical fastener assemblies 40 of Figures 2 and 3 may be integral with and located at the head portions of the mechanical fasteners of Figures 2 and 3 or the disks 42 of the mechanical fastener assemblies of Figures 2 and 3 may be separate and slidably mounted on the mechanical fasteners 42 of the mechanical fastener assemblies of Figures 2 and 3. The disk 42 of the mechanical fastener assembly 40 of Figure 4 would typically be separate from the mechanical fastener staple 42 of Figure 4 and the mechanical fastener staple 42 of Figure 4 would typically be driven through the disk as a roof sheet membrane is being secured to a roof substrate to complete the assembly of the mechanical fastener assembly 40 of Figure 4. The mechanical fasteners 42 and disks 44 of the mechanical fastener assemblies 40 of the subject invention would typically be made of conventional metallic and polymeric materials normally used to fabricate mechanical fasteners in the roofing industry.

Figures 5 to 9 show preferred embodiments of the disk 44 of the mechanical fastener assemblies 40 of the subject invention. As shown in Figures 6 and 7, a preferred form of the disks 44 of the mechanical fastener assemblies 40 has a peripheral separation edge 46 depending from an outer peripheral edge portion of the disk and, more preferably, from the outermost peripheral edge of the disk. The peripheral separation edge 46 of the disk has a depth "D". The depth "D" is the perpendicular distance between the plane P_1 containing the underside surface of the disk 44 when the underside surface of the disk rests on a release sheet after the mechanical fastener assembly incorporating the disk has been used to secure a roof sheet membrane to a roof substrate and a parallel or substantially parallel plane P_2 that contains the lowermost portions (e.g. the pointed ends of the series of the cutting edge teeth 48 forming the separation edge in Figure 8) or portion (e.g. the generally plane cutting edge 50 forming the separation edge of Figure 9) of the separation edge.

For a first number of selected applications, it may be desired to score the upper surface of a topside release sheet on a roof sheet membrane so that the topside release sheet easily and completely separates at the peripheral separation edge 46 of the disk 44 when the topside release sheet is removed from the roof sheet membrane. For such first selected applications, the depth "D" of the separation edge 46 of the disk 44 is selected so that the topside release sheet being cut by the separation edge 46 has a thickness greater than the depth "D" of the separation edge whereby the peripheral separation edge scores the topside release

sheet, preferably without passing completely through the topside release sheet, to weaken the topside release sheet at the peripheral separation edge 46 with no penetration of the roof sheet membrane and no degradation of the performance of the roof sheet membrane.

For a second number of selected applications, it may be desired to completely sever or substantially completely sever a topside release sheet on a roof sheet membrane so that the topside release sheet easily and completely separates at the peripheral separation edge 46 of the disk 44 when the topside release sheet is removed from the roof sheet membrane. For such second selected applications, the depth "D" of the separation edge 46 of the disk 44 is selected so that the topside release sheet being cut by the separation edge has a thickness equal to or substantially equal to the depth "D" of the separation edge whereby the peripheral separation edge 46 completely severs or substantially completely severs the topside release sheet with no or substantially no penetration of the roof sheet membrane and no or substantially no degradation of the performance of the roof sheet membrane.

While the disk 44 of the mechanical fastener assembly 40 shown in Figures 5 to 9 has a round configuration, it is contemplated that the disks 44 of the mechanical fastener assemblies 40 could have different configurations. By way of example, a first preferred disk would have a round configuration and typically have a diameter between about one and about three inches; a second preferred disk would have an oval configuration and have a major diameter between about one and about three inches and a minor diameter less than the major diameter; and a third preferred disk would have a generally rectangular or square configuration with dimensions between about one and about three inches. The size of the disks 44 is determined at least in part by the mechanical fastener pattern employed to anchor a roof sheet membrane to a roof substrate and the wind uplift resistance required for the application.

Figure 10 shows a partial schematic plan view of a base sheet membrane 24 with a self-adhering topside surface 30 that is covered by a topside release sheet 32. The topside release sheet 32 may be made of various sheet materials commonly utilized for release sheets. For example, the topside release sheet 32 may be made of a polypropylene film, having a thickness of about 40 to 60 microns, which is coated with a silicone release agent. The topside release sheet 32 is peeled back slightly at one corner to reveal the self-adhering topside surface 30 of

the base sheet membrane 24. The self-adhering topside surface 30 of the base sheet membrane is typically an asphalt or modified asphalt coating commonly utilized in the roofing industry. The base sheet membrane 24 is secured to a roof substrate by a plurality of the mechanical fastener assemblies 40 of the subject invention.

Figure 11 shows the topside release sheet 32 after the topside release sheet has been partially torn away (in the process of being removed from the base sheet membrane) in accordance with the method of the subject invention to expose the self-adhering topside surface 30 of the membrane prior to adhering an overlying roofing layer to the self-adhering topside surface 30 of the membrane. As shown in Figure 11, preferably, the release sheet 32 separates completely at the peripheral edges of the disks 44 to form holes 34 in the release sheet that have the same or substantially the same configuration and shape as the disks 44 so that no stringers or scraps of the release sheet 50 extend out from the disks 44 over the self-adhering topside surface 30 of the base sheet membrane 24 to interfere with the bonding of an overlying layer to the base sheet membrane. Once the release sheet 32 has been removed to expose the self-adhering topside surface 30 of the base sheet membrane 24, an overlying layer of the multi-layer roofing system 20, such as but not limited to a cap sheet membrane 26, is applied and bonded to the self-adhering topside surface 30 of the base sheet membrane.

The portions of the topside release sheet 32, that are overlaid by the disks 44 and that remain under the disks 44 after the topside release sheet 32 has been torn or otherwise removed from the base sheet membrane 24, support or at least lend support to the disks 44 of the mechanical fastener assemblies 40 to prevent or help prevent the disks from being driven into the base sheet membrane 24 and thereby preserve the performance of the base sheet membrane when roofers step on the mechanical fastener assemblies 40 while working on the roof during or subsequent to the installation of the multi-layer roofing system.

In describing the invention, certain embodiments have been used to illustrate the invention and the practices thereof. However, the invention is not limited to these specific embodiments as other embodiments and modifications within the spirit of the invention will readily occur to those skilled in the art on reading this specification. Thus, the invention is not intended to be limited to the specific embodiments disclosed, but is to be limited only by the claims appended hereto.